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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/581,507	04/25/2007	Marie Holmgren	616562000300	8409

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EXAMINER	
ARIANI, KADE	

ART UNIT	PAPER NUMBER
1651	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/581,507	HOLMGREN ET AL.	
	Examiner	Art Unit	
	KADE ARIANI	1651	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-6,8-21,23-31 and 34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-6,8-21,23-31 and 34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/28/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The amendment filed on October 28, 2008, has been received and entered.

Claims 3, 7, 22, 32, and 33 have been canceled.

New Claim 34 has been added.

Claims 1, 2, 4-6, 8-21, 23-31 and 34 are pending in this application and were examined on their merits.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/28/2008 has been entered.

IDS

The information disclosure statement (IDS) submitted on 10/28/2008 is being considered by the examiner.

Declaration under 37 C.F.R. § 1.132

The Declaration of Peter Gustafsson under 37 CFR 1.132 filed on 10/28/2008 is considered but is insufficient to overcome the rejection of claims 1-33 under 35 U.S.C. 103(a) as set forth in the last Office action because:

Declarant argues that the observed increased ethanol yield using the mix of *Chalara* and *Trametes* fungi is unexpected because one would expect the mix of fungi to have an ethanol production rate equal to their individual production rates, and the observed results are at least two times more than one would have expected.

However, the greater than additive effect on ethanol production is not necessarily sufficient to overcome a prima facie case of obviousness because such an effect can be expected. As mentioned immediately below, Lee et al. teach, ethanol is an effective stimulator for laccase production in *Trametes versicolor*, over 20 times higher than without ethanol. Lee et al. also teach laccase is important in degrading lignin in wood pulp.

Therefore, a person of ordinary skill in the art at the time the invention was made would have expected to obtain a greater than additive increase in the rate of ethanol production during the fermentation of lignin-containing material (wood) by a mixture of *Chalara* and *Trametes* fungi. Because one of ordinary skill in the art at the time the invention was made would have expected the stimulation in the production of laccase (lignin degrading enzyme) by *Trametes versicolor* in the mixture in the presence of ethanol, and more laccase would increase the degradation rate of lignin to hexose and pentose sugars that could be readily fermented by the mixture of fungi, which in turn would increase ethanol production rate.

Applicant's arguments with respect to claims 1-33 filed on 10/28/2008 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 4-6, 8-21, 23-31 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, J. (Journal of Biotechnology, 1997, Vol. 56, p1-24) in view of Robles et al. (Enzyme and Microbial Technology, 2002, Vol. 31, p.516-522) and Lundquist et al. (Arch. Microbiol, 1977, Vol.112, p.291-296) and further in view of Nag Raj & Hughes (in IDS, New Zealand Journal of botany, 1974, Vol. 12. p.115-129) and further in view of Lee et al. (Biotechnology Letters, 1999, Vol. 21 p.965-968)

Claims 1, 2, 4-6, 8-19, 29-31 and 34 are drawn to a process for production of ethanol through fermentation of organic starting materials, the process comprising, metabolizing pentose compounds of the organic starting materials using a mix of at least two fungi, the mix comprising a fungus of the genus *Chalara* and a fungus of the genus *Trametes*, said fungus mix being capable of metabolizing pentose compounds to

produce ethanol, *Chalara parvispora*, *Trametes versicolor*, the process wherein said mix of fungi further comprises one or more fungi from the group consisting of *Trichoderma sp., Thielavia sp., Posita sp.,*, *Gloephyllum sp., Phanerochaete sp.,* the process wherein said mix of fungi is used in combination with at least one yeast, said yeast is *Saccharomyces cerevisiae*, fermentation is batch fermentation, a continuous or semi-continuous process, the pH is adjusted to the range of 4.5-7, the pH is in the range of 5.5-6.5, the pH is about 6.0, the temperature is in the interval of about 20 to about 40°C, the temperature is in the interval of about 26 to about 36°C, the process wherein the starting material chosen among wood or non-wood plant material, and a starter culture for use in the process of claim 1, comprising the genus *Chalara* and the genus *Trametes,* the starter culture comprising *Chalara parvispora*, and *Trametes versicolor*, and at least one of *Trichoderma viride*, *Thielavia terrestris*, *Posita placenta*, *Gloephyllum trabeum*, *Phanerochaete chrysosporium*, and a combination thereof, further comprising a yeast, and at least one fungus selected from the group consisting of *Trichoderma sp., Thielavia sp., Posita sp.,*, *Gloephyllum sp.,* and *Phanerochaete sp.*

Claims 20, 21, 23-28 are drawn to a process for the production of ethanol from a starting material consisting substantially of waste or by-products from forestry, the process comprising, metabolizing pentose compounds of the starting material consisting substantially of waste or by-products from forestry, using a mix of at least two fungi, the mix comprising a fungus of the genus *Chalara* and a fungus of the genus *Trametes*, capable of metabolizing pentose compounds, *Chalara parvispora*, and *Trametes versicolor*, the fungi mix further comprises one or more fungi chosen from *Trichoderma*

sp., Thielavia sp., Posita sp.,, *Gloephyllum sp., Phanerochaete sp ,* and a combination therefore, *Trichoderma viride*, *Thielavia terrestris*, *Posita placenta*, *Gloephyllum trabeum*, *Phanerochaete chrysosporium*, and the mix is used in combination of the at least one yeast, waste material comprises the spent liquor from pulping.

Lee teaches the biological process of ethanol production utilizing lingocellulose (raw material from hard wood, soft wood, grasses, agricultural waste, office paper) as substrate requires, delignification to liberate cellulose and hemicellulose from their complex with lignin, depolymerization of the carbohydrate polymers (cellulose and hemicellulose) to produce free sugars and fermentation of mixed hexose and pentose sugars to produce ethanol. Lee also teaches the delignification of lingocellulosic raw material is the rate limiting and most difficult task to be solved (Abstract and p.2 1st column 1st paragraph lines 3-8, 2nd paragraph lines 8-15, and 20-22). Lee teaches the advantages of biological delignification and subsequent direct ethanol fermentation over previous methods may include mild reaction conditions and higher yields. Lee teaches lignin has been reported degradable by several fungal enzymes, lignin peroxidase, Mn-dependent peroxidase, and laccase (p.2 2nd column 2nd paragraph lines 9-12). Lee teaches subsequent ethanol-producing process employs cellulase-producing microbes for the depolymerization of the cellulose and ethanol fermentation. Cellulase enzymes are produced by a number of microbes, including fungi, yeast, and bacteria (p.2 2nd column 3rd paragraph lines 1-6). Lee teaches lignin is extremely resistant to degradation and biological degradation is achieved mainly by fungi, most efficiently by white-rot basidomycetes, but also by certain actinomycetes. Lee teaches lignin-degrading

cultures of fungal strains *Trametes versicolor, Posita placenta*, and *Phanerochaete chrysosporium* (p. 4 1st column 3rd paragraph lines 19-23 and p.8 Table 2. 1st column lines 2 and 9). Lee further teaches lignin-degradation by a mixed culture of two white-rot fungi (p.10 2nd column 1st paragraph). It must be noted that *Trametes versicolor* is a white-rot fungus. Lee also teaches most white-rot fungi grow best at a slightly acidic pH between 4 and 5, and most white-rot fungi are mesophiles with temperature optimum between 15 and 35°C (p.11 1st column 1st paragraph).

Lee does not teach a fungus of genus *Chalara, and Chalara parvispora*. However, Robles et al. teach metabolizing organic material using a fungal species of genus *Chalara* (syn. *Thielaviopsis*), at pH about 6 (5.6), temperature is in the interval of 26 to 36°C (28°C) for fermentation of waste stream from food industry (Kraft lignin and olive mill waste water)(Abstract, p. 517 1st column 1st paragraph lines 1-4 and 2nd paragraphs line 2). (It must be noted that Kraft lignin is lignin which is altered by the pulping process called Kraft, see Lundquist et al. Introduction 1st column 1st paragraph). Robles et al. teach laccase enzyme has high percentage of activity in the presence of organic solvents including ethanol (Abstract). Robles et al. also teach enzymatic reactions in organic solvents to change the direction of catalytic reactions and to gain access to insoluble substrates, and the use of compatible solvents may facilitate transformation of the insoluble lignin components. Robles et al. further teach olive oil wastewater is a phenolic-rich effluent and hence a good candidate for degradation by fungal laccases. Moreover, the antimicrobial activity of olive oil mill wastewater has been attributed to its phenolic constituents are responsible for inhibition of

biomethanisation process. The use of fungal species in two–stage fermentation processes may help for the biodegradation of olive mill wastewater, and strains of *Chalara (paradoxa)* may be of interest for detoxification and/or composting of industrial wastes (from olive oil extraction industry) (p.521 1st column 1st paragraph and 3rd paragraph).

Moreover, Nag Raj & Hughes teach *Chalara parvispora*. Nag Raj & Hughes teach *Chalara* are capable of growing on wood and decayed wood (see the whole document especially page 117).

Further motivation is in Lee et al. who teach ethanol is an effective stimulator for laccase production in *Trametes* species. Lee et al. teach laccase is important in degrading lignin in wood pulp and in decolorizing and detoxifying the vast amount of effluents generated by the pulp and paper industry (p. 965, Abstract, Introduction 1st and 2nd column 2nd paragraph). Lee et al. teach in the presence of ethanol laccase production was over 20 times higher than without ethanol. Lee et al. teach it seems that ethanol is effective with many white-rot fungi that produce laccase (Abstract, p.967 2nd column 2nd paragraph lines 13-15).

Therefore, in view of the above teachings, a person of ordinary skill in the art at the time the invention was made could have been motivated to use fungus *Chalara* as taught by Robles et al. and Nag Raj & Hughes in the method of Lee to provide a process for the production of ethanol through fermentation with predictable results of increased lignin-degrading activity in the process due to the induction of laccase, increased amount of hexose and pentose sugars that could be readily fermented by the

mixture of fungi, and increased ethanol production. The motivation to use a mixture of a fungus of genus *Chalara* and of the genus *Trametes* in a process for the production of ethanol through fermentation of waste products from wood and food industry as taught by Robles et al. would be because laccase enzyme of *Chalara* had high percentage of activity in the presence of ethanol, the use of fungal species for detoxification and composting of industrial wastes, higher hydrolytic efficiency, and as taught by Lee et al. would be because ethanol was an effective stimulator for laccase production in *Trametes* species.

Conclusion

No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kade Ariani whose telephone number is (571) 272-6083. The examiner can normally be reached on 9:00 am to 5:30 pm EST Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Wityshyn can be reached on (571) 272-0926. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

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Kade Ariani
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